

Shear correlation

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group meeting July/14/2015 11:30am

Goals

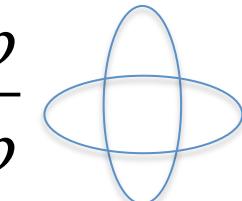
- compare shear from x-rays and in Phosim
 - only sensor diffusion, no TRs etc; no atmo
- learn about spurious shear in LSST and reproduce Chihway's results with updated Phosim

Shear

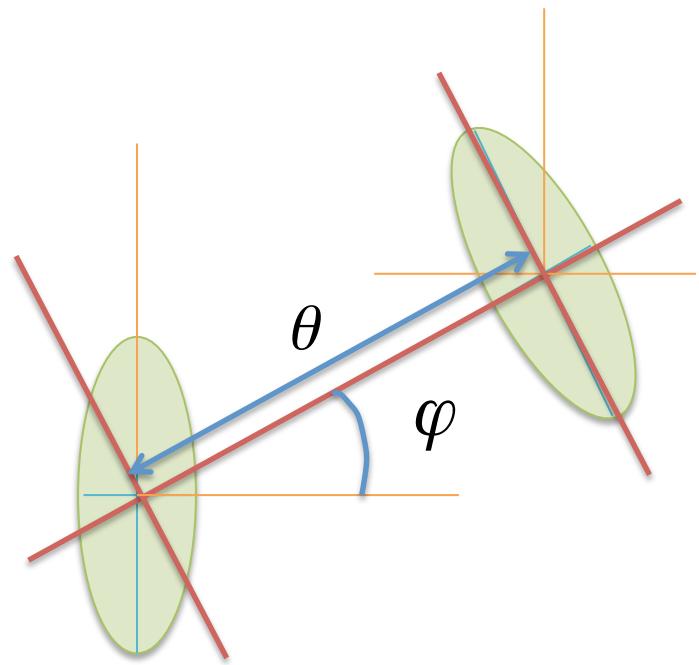
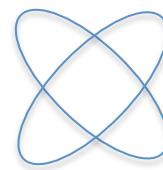
- use MCMC mode in ngmix (E.Sheldon) to fit 2D Gauss (x, y, flux, sigma, g1, g2)

$$\vec{g} = g_1 + i g_2$$

$$g_1 = \frac{I_{11} - I_{22}}{I_{11} + I_{22}} = \frac{a - b}{a + b}$$



$$g_2 = \frac{2I_{12}}{I_{11} + I_{22}}$$



Correlation Function

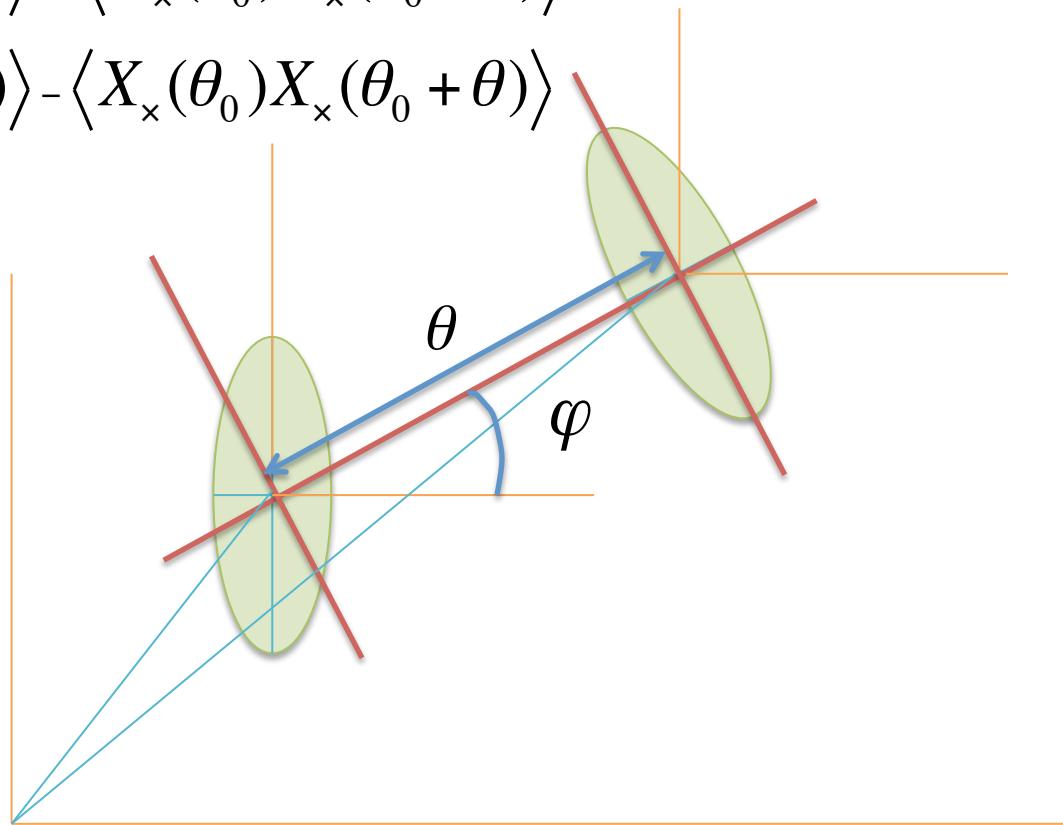
- Using TreeCorr (M.Jarvis) and notations from arxiv:1206.137804 (Chihway Chang)

$$\xi_+(\theta) = \langle X_+(\theta_0)X_+(\theta_0 + \theta) \rangle + \langle X_x(\theta_0)X_x(\theta_0 + \theta) \rangle$$

$$\xi_-(\theta) = \langle X_+(\theta_0)X_+(\theta_0 + \theta) \rangle - \langle X_x(\theta_0)X_x(\theta_0 + \theta) \rangle$$

$$X_+ = \text{Re}(\vec{g}e^{-2i\varphi})$$

$$X_x = \text{Im}(\vec{g}e^{-2i\varphi})$$



PHOSIM?



wavelength, RA, DEC, x&y location, number, type,.. etc

atmosphere

clouds, wind, temperature, water pressure,... etc

dome seeing

telescope

tracking, shutter error,... etc

instrument

ccd temperature, silicon thickness,...etc

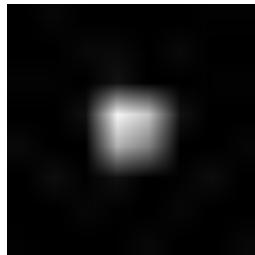
Generated PHOSIM datasets

- without atmosphere
 - 420nm (default pixel size 10.0um)
 - 420nm with pixel size 5.0um
 - 850nm (default pixel size 10.0um)
- with atmosphere (dome seeing 2.0'')
 - 420nm (default pixel size 10.0um)
 - 850nm (default pixel size 10.0um)
(+10000 point sources on one sensor)

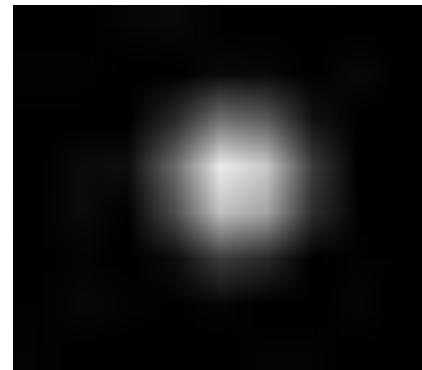
PHOSIM: generate a monochromatic star, change parameters

fit with 2D Gauss: flux, x, y, sigma, g1, g2

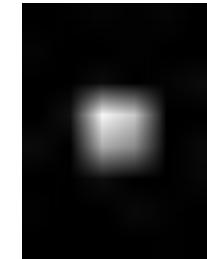
without atmosphere



420nm, pixel size 10.0um,
absorbed on the surface
 λ (absorption depth)=0.3um



420nm
pixel size 5.0um



850nm, $\lambda = 30$ um
pixel size 10.0um

with atmosphere



420nm
pixel size 10.0um

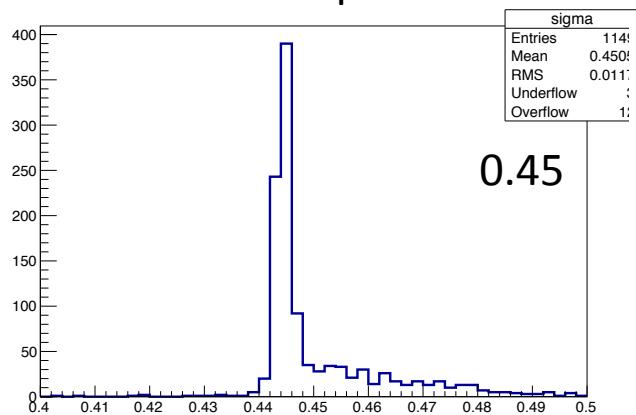
850nm
pixel size 10.0um



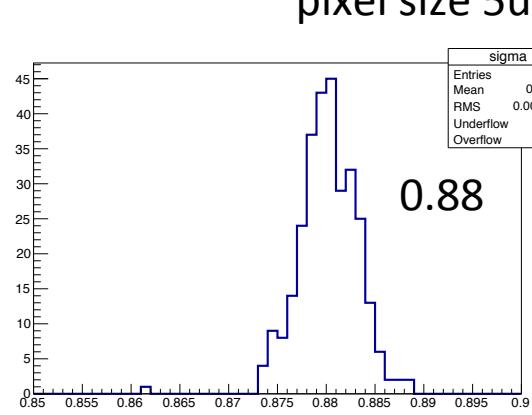
sigma, see tails, want to study this

without atmosphere

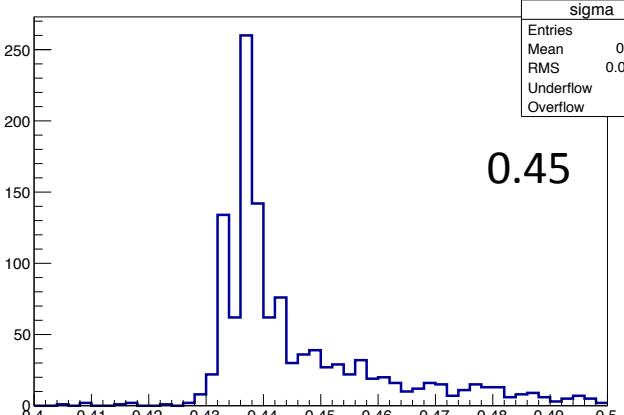
420nm
pixel size 10um



420nm
pixel size 5um

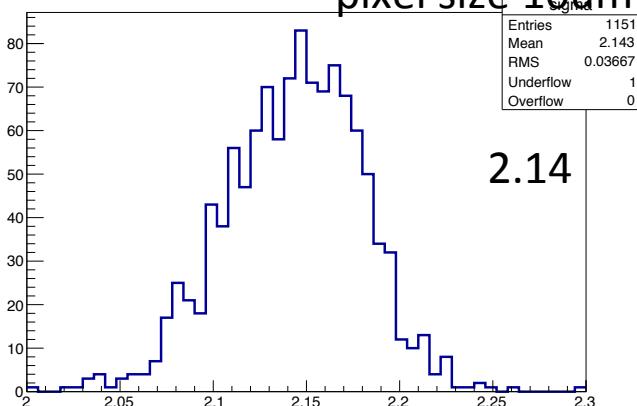


850nm
pixel size 10um

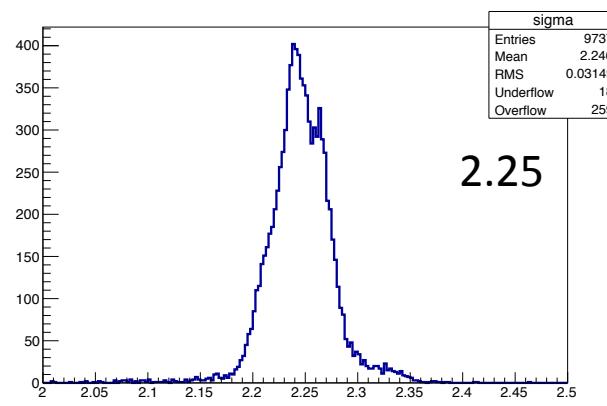


with atmosphere

420nm
pixel size 10um



850nm, 10000 stars
pixel size 10um



$$\text{ellipticity} = \sqrt{g_1^2 + g_2^2}$$

without atmosphere

420nm

pixel size 10um

ellipticity				
Entries	1149			
Mean	0.009602			
RMS	0.008449			
Underflow	0			
Overflow	20			

0.0096

420nm

pixel size 5um

ellipticity				
Entries	297			
Mean	0.004676			
RMS	0.002359			
Underflow	0			
Overflow	1			

0.0047

850nm

pixel size 10um

ellipticity				
Entries	1240			
Mean	0.0115			
RMS	0.008576			
Underflow	0			
Overflow	23			

0.0115

with atmosphere

420nm

pixel size 10um

ellipticity				
Entries	979			
Mean	0.009102			
RMS	0.009003			
Underflow	0			
Overflow	15			

0.0091

850nm, 10000 stars

pixel size 10um

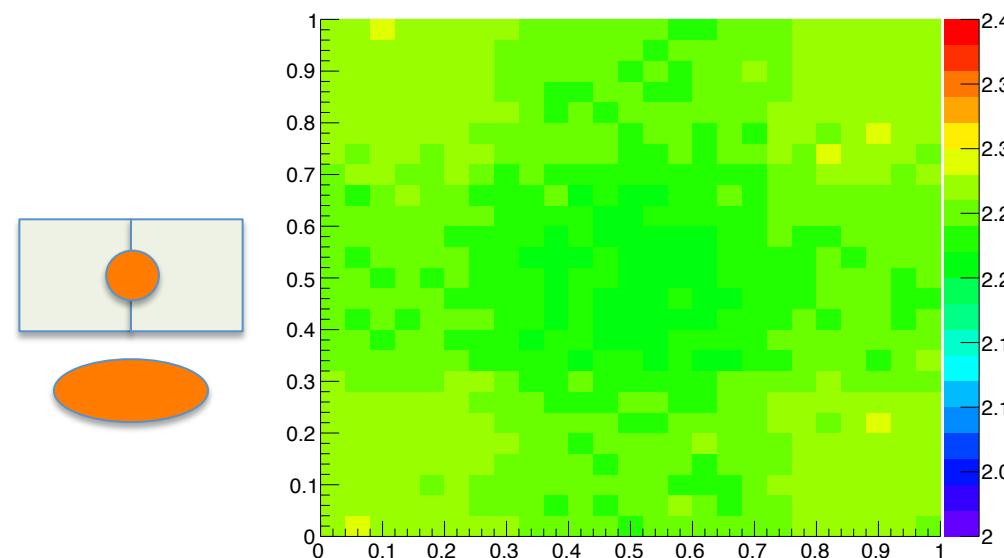
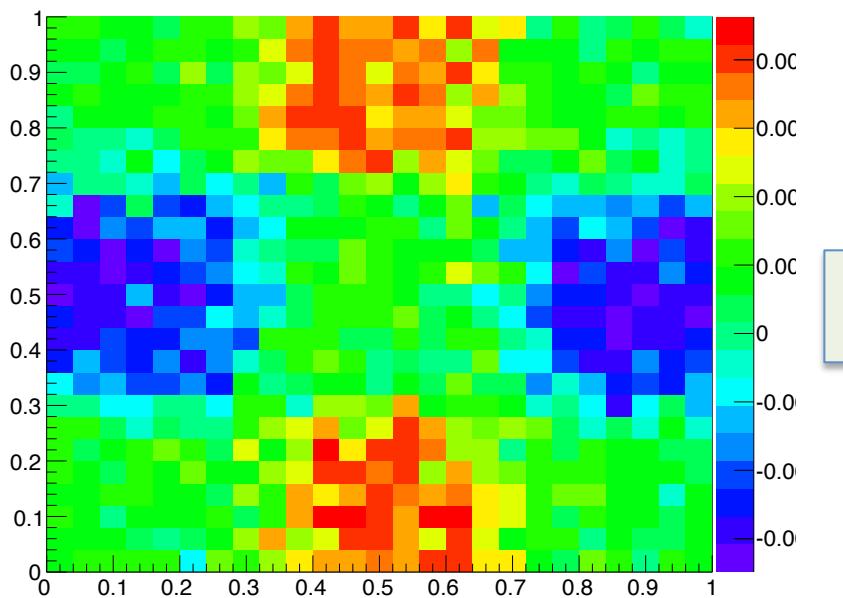
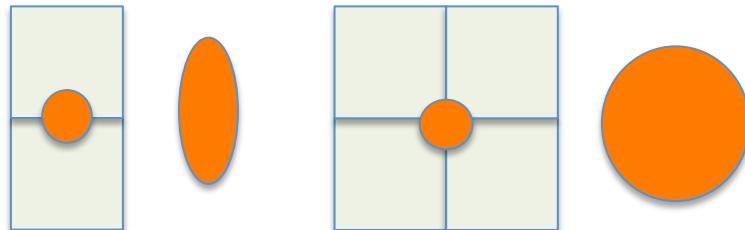
ellipticity				
Entries	9737			
Mean	0.008174			
RMS	0.005563			
Underflow	0			
Overflow	260			

0.0082

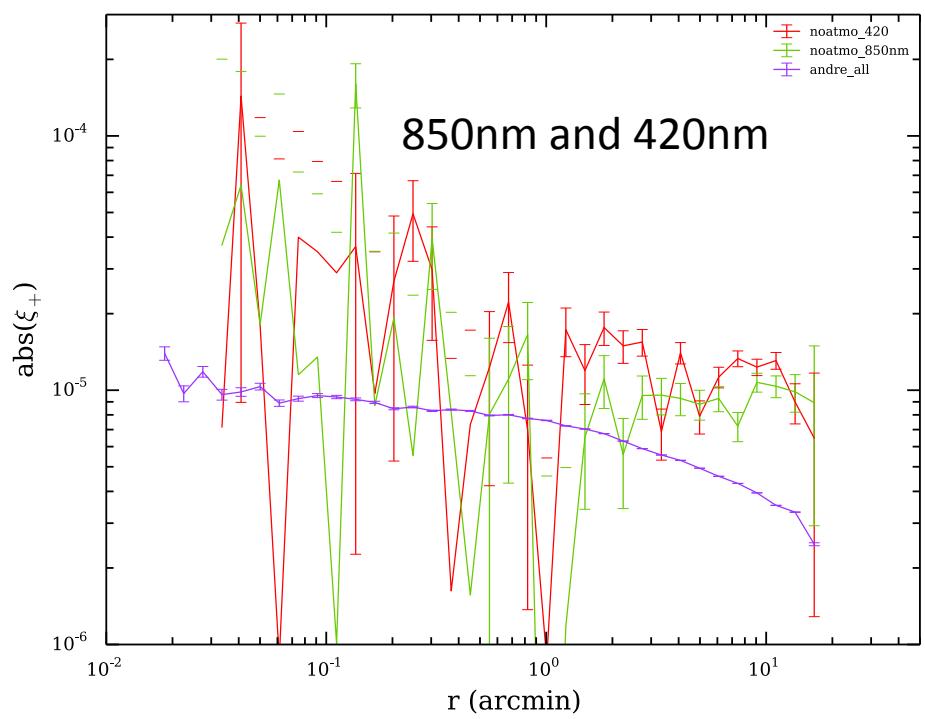
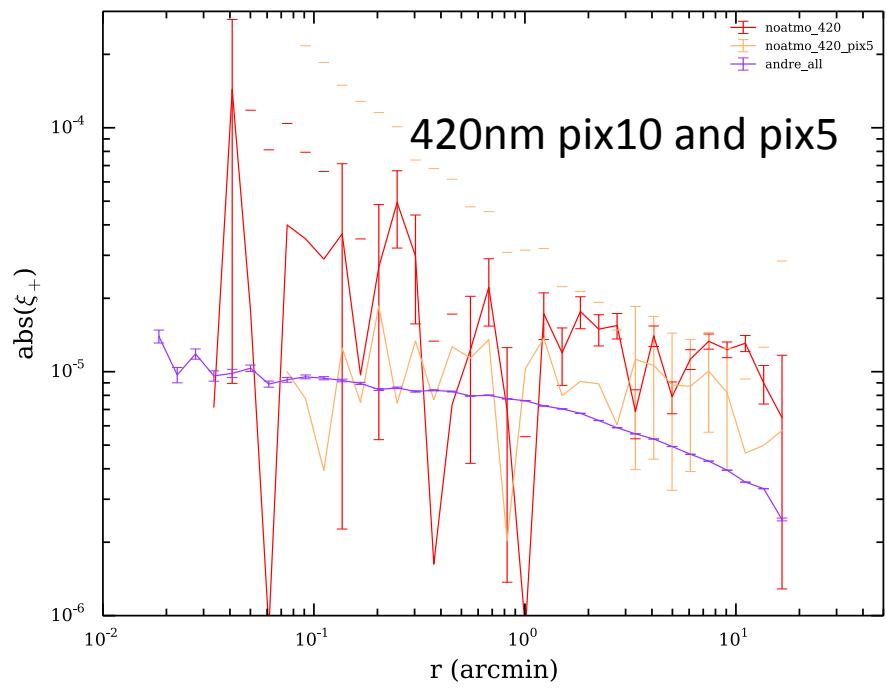
x-y intra pixel g1&sigma

with atmosphere

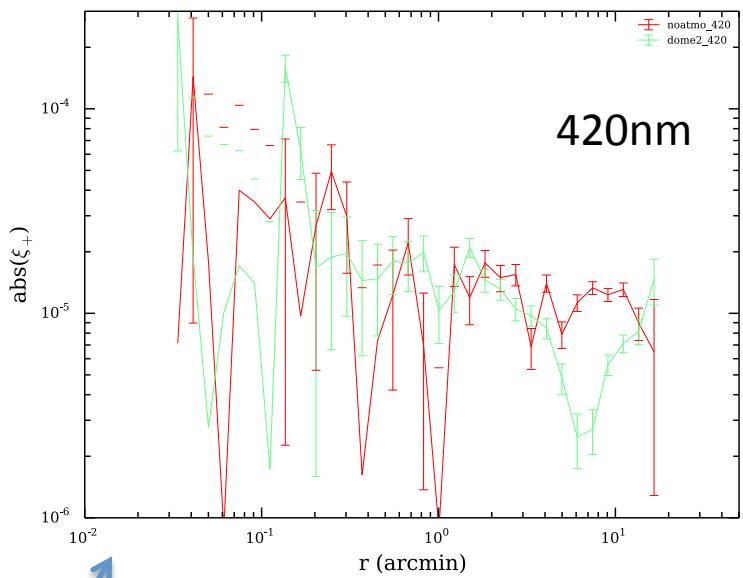
850nm, 10000 stars
pixel size 10.0um



Phosim vs lab data (x-rays) (without atmosphere)

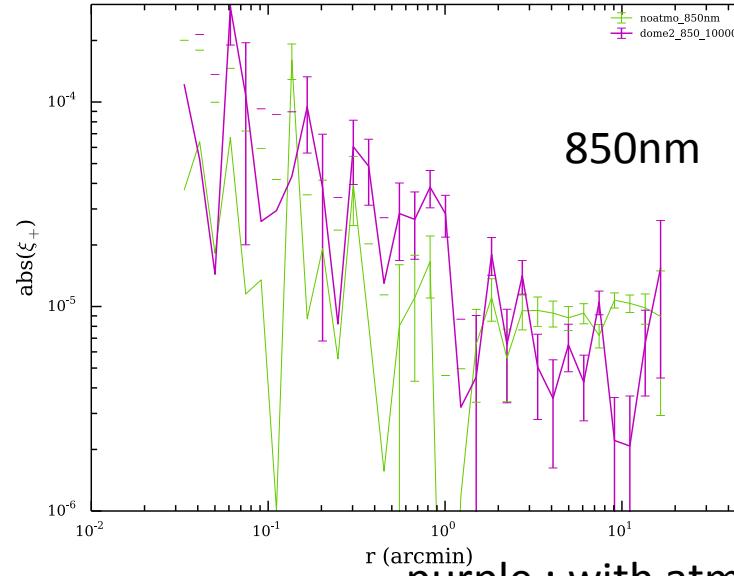


with and without atmosphere



420nm

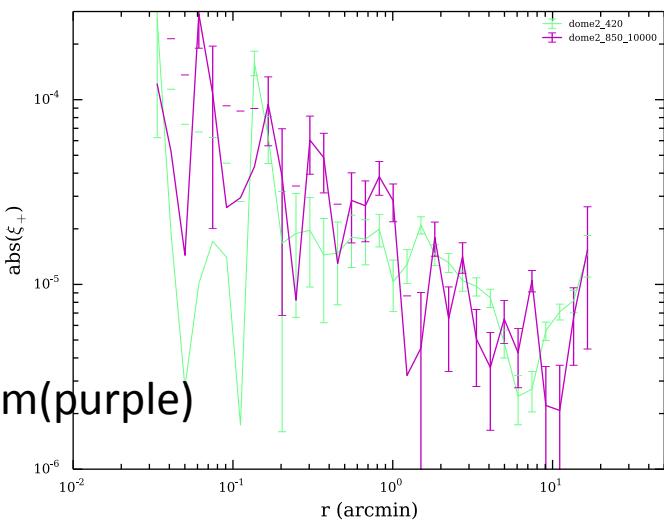
red: no atmosphere
green: with atmosphere



850nm

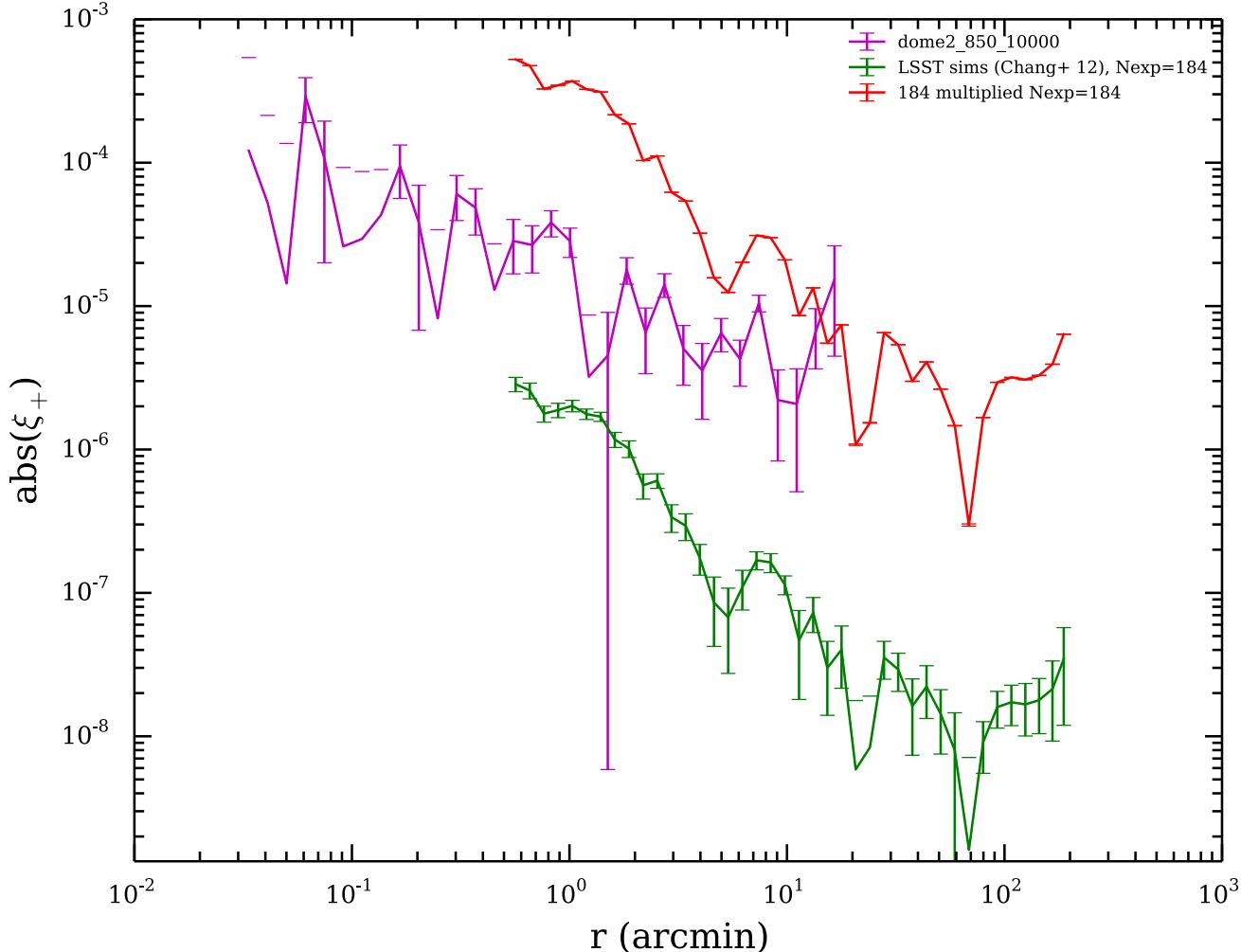
purple : with atmosphere
green : no atmosphere

420nm(green) and 850nm(purple)
with atmosphere



Phosim vs Chihway's data

dome seeing 2.0, 850nm, 10000 point sources



Plans

- increase number of stars in one sensor
- combine sensors to raft then to whole LSST focal plane
- calculate X_+X_+ and X_xX_x separately

$$\xi_+(\theta) = \langle X_+(\theta_0)X_+(\theta_0 + \theta) \rangle + \langle X_x(\theta_0)X_x(\theta_0 + \theta) \rangle$$

$$\xi_-(\theta) = \langle X_+(\theta_0)X_+(\theta_0 + \theta) \rangle - \langle X_x(\theta_0)X_x(\theta_0 + \theta) \rangle$$

- convert correlations to power spectrum by Fourier Transform